ClimateWins

Machine Learning Model Prediction of Weather Conditions & Climate Changes

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Project Overview

Background

ClimateWins, a European nonprofit organization, is interested in using machine learning to help predict the consequences of climate change around Europe and, potentially, the world.

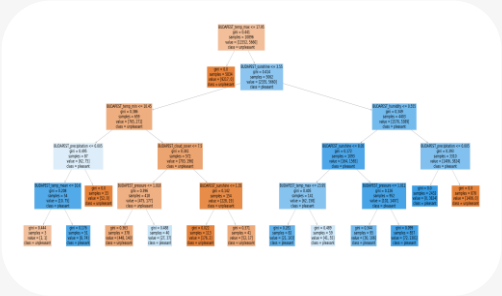
Objective

To investigate and explore the possibility of the various machine learning models available for:

1. Unusual weather pattern recognitions within Europe.
2. Unusual weather pattern trend detection.
3. Future prediction for weather conditions and safest European region.

Machine Learning Algorithms

Random Forest

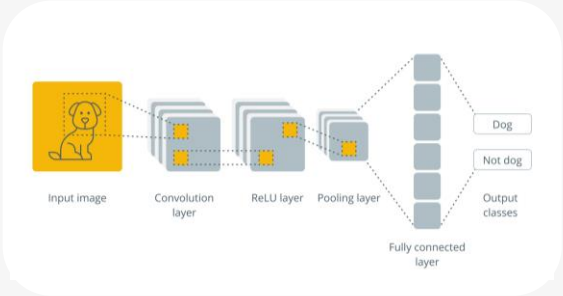


- Ensemble learning algorithm that uses multiple decision trees to produce a final prediction by averaging the predictions of all the trees.

Applications

- Feature importance analysis for prediction of pleasant day.

Convolutional Neural Network (CNN)

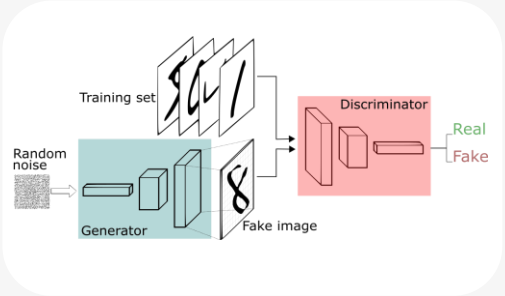


- Neural networks that specializes in processing data that has a grid-like topology, such as an image, to detect features from the data set.

Applications

- To extract patterns/features from historical weather data and forecast future weather conditions.

Generative Adversarial Network (GAN)



- Deep learning architecture which trains two neural networks to compete against each other to generate more authentic new data from a given training dataset.

Applications

- Prediction of future weather conditions through visual media.

Unusual Weather Pattern Recognitions Within Europe

Concept

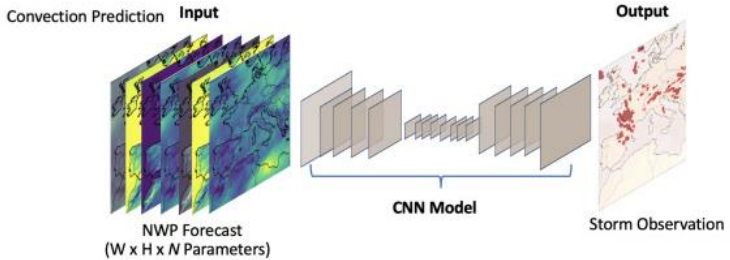
- To compare current and historical weather data in Europe to identify any unusual weather pattern appearing due to climate changes.

Data Required

- Historical weather data of Europe over the last 60 years.
- Historical satellite images of Europe over the last 60 years.

Algorithms to consider

- **CNN:** To detect and identify features and patterns which constitute to unusual weather from current and historical weather dataset and images.
- **GAN:** To detect and identify patterns from current and historical satellite images.



Unusual Weather Pattern Trend Detection

Concept

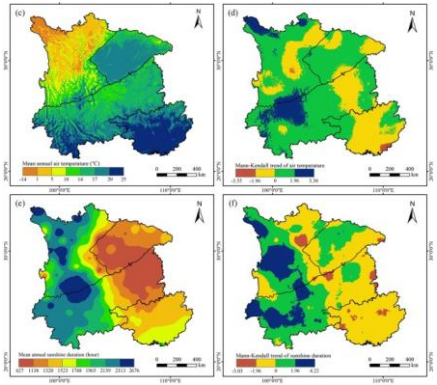
- To compare current and historical weather data in Europe to determine if there is an increase in frequency and magnitude of unusual weather patterns (hurricane, thunderstorms).

Data Required

- Historical weather data of Europe over the last 60 years.
- Historical data of hurricanes in Europe over the last 60 years.

Algorithms to consider

- **Random Forest:** To train model with current and historical weather and hurricane data to identify unusual weather patterns. Compare the identified trend over the years to determine if there is an increase for the unusual weather.



Future prediction for weather conditions and safest European region

Concept

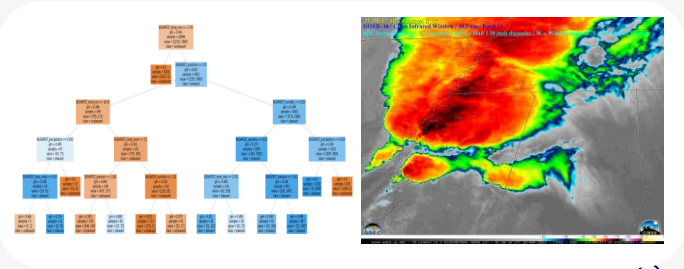
- To use machine learning generate possibilities for future weather conditions over the next 25 to 50 years based on current trends and determine the safest places for people to live in Europe over the next 25 to 50 years.

Data Required

- Historical weather data of Europe over the last 60 years.
- Historical satellite images of Europe over the last 60 years.

Algorithms to consider

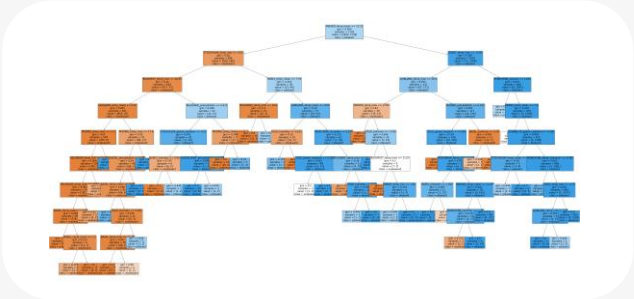
- **Random Forest:** To use past historical weather data to build prediction model to predict future weather conditions.
- **GAN:** To identify patterns from current and historical satellite images to locate the safest location in Europe which have the least unusual weather (hurricane, thunderstorm).



Summary

Insights

- **Random forest** have high accuracy in prediction of pleasant and unpleasant weather.
  - ✓ Highest overall accuracy of **97.81% correct prediction**.
- **Maximum temperature** and **precipitation** was identified as the **top 2 factors** for **prediction of pleasant and unpleasant weather.**



Recommendations

- To use proceed with **though experiment 3** for **the future prediction for weather conditions and safest European region**.
- To use the **random forest model** to build a model to **predict future weather conditions based on past historical weather data.**
  - Weather data to consider should be **maximum temperature** of the region and **precipitations** for the regions.
  - **Breakdown the data** to the **4 various seasons of the year** and use those data separately for better prediction due to less drastic fluctuations for each of the different seasons weather variables.
- To use **GAN model** to identify detect and identify patterns from **current and historical satellite images** to see which safest location in Europe to live in which have the least unusual weather (hurricane, thunderstorm).

Thanks!

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